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pulling the fertilized flower down through the water without turning it around. If I am correct in the observation that some plants of Vallisneria have the dextral twist at the lower part, and others have the sinistral twist below, this would be a complex of the primitive antidromy having superposed upon it a recently acquired didromy.

A different line of investigation will search out the relation of dextrorse or sinistrorse phyllotaxy to the leaf-traces in the stem. I am convinced that inattention to this point has marred some of the work on the histology and the plan of the fibrovascular bundles, and that even with opposite-leaved plants, many species will be found to exhibit a duplicate pattern as between the arrangements in different individuals of a species.—GEORGE MACLOSKIE.

Princeton College, March 16, 1896.

VEGETABLE PHYSIOLOGY.[1]

A New Classification of Bacteria.—In a recent number of *Die Natürlichen Pflanzenfamilien* (Lieferung 129, Leipsic, 1896) Prof. W. Migula, of Karlsruhe, gives a classification of the bacteria which is much more practical and satisfactory than that of Dr. Alfred Fischer, noticed in the September (1895) number of this journal. Migula's arrangement seems, on the whole, to be the best yet devised, and will probably come into general use, at least among botanists. The characters of several genera are amended, properly it seems to the writer, e. g., *Bacterium, Bacillus, Streptothrix,* and other genera are discarded as being founded on purely biological grounds, e. g., *Photobacterium, Nitromonas, Clostridium.* Of course, biological peculiarities are recognized as indispensable in the differentiation of species. In reading this paper one is occasionally surprised at the omissions, but taken in its entirety the work of consulting literature seems to have been very carefully done, and what is more important the classification appears to have grown out of a long and wide experience in the laboratory, and seems to be eminently usable. This paper treats briefly of most important literature, morphology, vegetative condition, resting state, cultures on artificial media, biological peculiarities, geographical distribution, relationships, earlier classifications, etc., and then proceeds to the description of the families and genera. The group Schizomycetes forms the first section of the Schizophyta, and is divided into five families; Coccaceæ, Bacteriaceæ, Spirillaceæ, Chlamydobacteriaceæ and Beggiatoaceæ, as follows:

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[1] This department is edited by Erwin F. Smith, Department of Agriculture, Washington, D. C.

I. Cells globose in a free state, not elongating in any direction before division into 1, 2 or 3 planes	1. Coccaceæ.
II. Cells cylindrical, longer or shorter, only dividing in one plane, and elongating to twice the normal length before the division.	
(1) Cells straight, rod-shaped, without a sheath, non-motile or motile by means of flagella	2. Bacteriaceæ.
(2) Cells crooked, without a sheath	3. Spirillaceæ.
(3) Cells enclosed in a sheath	4. Chlamydobacteriaceæ.
(4) Cells destitute of a sheath, united into threads, motile by means of an undulating membrane	5. Beggiatoaceæ.

The genera recognized by Prof. Migula are as follows:

(1) Coccaceæ	
A. Cells without organs of motion	
a. Division in one plane	1. Streptococcus.
b. Division in two planes	2. Micrococcus.
c. Division in three planes	3. Sarcina.
B. Cells with organs of motion	
a. Division in two planes	4. Planococcus.
b. Division in three planes	5. Planosarcina.
(2) Bacteriaceæ	
A. Cells without organs of motion	1. Bacterium.
B. Cells with organs of motion (flagella)	
a. Flagella distributed over the whole body	2. Bacillus.
b. Flagella polar	3. Pseudomonas.
(3) Spirillaceæ	
A. Cells rigid, not snake-like flexuous	
a. Cells without organs of motion	1. Spirosoma.
b. Cells with organs of motion (flagella)	
1. Cells with 1, very rarely 2–3 polar flagella	2. Microspira.

2. Cells with polar flagella-tufts	3. Spirillum.
B. Cells flexuous	4. Spirochæta.
(4) Chlamydobacteriaceæ	
A. Cell contents without granules of sulfur	
a. Cell threads unbranched	
I. Cell division always only in one plane	1. Streptothrix.
II. Cell division in three planes previous to the formation of conidia	
1. Cells surrounded by a very delicate, scarcely visible sheath (marine)	2. Phragmidiothrix.
2. Sheath clearly visible (in fresh water)	3. Crenothrix.
b. Cell threads branched	4. Cladothrix.
B. Cell contents containing sulfur granules	5. Thiothrix.
(5) Beggiatoaceæ	

Only one genus known (Beggiatoa Trev.) which is scarcely separable from *Oscillaria.* Character as given under the family.

This scheme is simple in comparison with that of Fischer, but to fully appreciate it one should compare it with that of de Toni and Trevisan in Saccardo's *Sylloge Fungorum*, where cumbrousness and triviality reach a climax, these authors breaking up the group into no less than 50 genera.

From among the various general statements we cull the following: For the most part the wall of the cell is formed not out of cellulose or any similar carbohydrate, but out of albuminoids. The wall may, however, contain embedded in its substance variable quantities of a carbohydrate coloring blue with iodine. There is no "centralkörper" in the true bacteria, but vacuoles have frequently been mistaken for such bodies. Most bacterial pigments are non-nitrogenous bodies related to the analin colors; others are nitrogeneous substances related to the albuminoids, such apparently are the fluorescent pigments. The manner of cell division is a fundamental distinction between Bacteriaceæ and Coccaceæ. Cell division always takes place at right angles to the longitudinal axis when any such is clearly visible. With few exceptions motility is accomplished by means of flagella. These are extremely delicate protoplasmic structures originating directly from the membrane. This mode of origin makes it still more probable that the wall of the cell is only an external denser layer of plasm. Bacteria in which the contents has been drawn away from the point of insertion of the flagella by plasmolysis are apparently still capable of motion. The flagella are either fastened to one or both poles of the cell or else are scattered irregularly over the whole body. This position of the flagella on the bacterial body is constant and may be used to distinguish genera. In some species all of the plasma of the mother cell is not used up in spore formation, but sometimes a considerable part is left in the rod. In germination the spores swell up, lose their refractive power, and usually open either at the pole or equatorially allowing the young germ to protrude, but sometimes the wall of the spore entirely deliquesces before the germ has protruded, the latter simply elongating as a vegetative cell. It is not always easy to determine the character of the refractive contents of bacterial cells, and in such cases absolute demonstration of their sporiferous nature can only be had by seeing them germinate. All bacterial cells may pass into a resting state when for any reason growth ceases, but such cells do not possess any spore character and are only ordinary vegetative cells under conditions unfavorable to growth. Arthrospores do not exist, and this term should be discarded. Gonidia occur in the Chlamydobacteriaceæ. In *Cladothrix* these bodies escape from the sheath as swarm cells. In *Crenothrix* and *Phragmidiothrix* the contents of the vegetative cells becomes septated into Sarcina-like cubical packets, the individual cells of which finally round off and escape on the opening of the sheath as non-motile bodies which soon grow out into new threads. In *Streptothrix* the contents of the cell breaks up into a series of ovoid or round non-motile cells which escape from the sheath and grow wherever they happen to lodge.

This paper can be had from Wilhelm Engelmann, Leipsic, for 3 marks, and ought to be in the hands of every working bacteriologist.

ERWIN F. SMITH.

Ambrosia Once More.—There are two species of *Xyleborus* which bore in orange wood, one is *X. fuscatus* and the other is really undescribed, but goes well enough for the present under the name of *X. pubescens.* Both of these are associated frequently with *Monarthrum fasciatum* and *Monarthrum mali,* not only in the orange but in other hard wood trees of any kind, and even in the wood of wine and ale casks, in which they are able to propagate their "ambrosia" as well as in living or rather in dying trees. The ambrosia is very probably a different fungus for the different species of these beetles, even where several species occur in the same tree trunk. The ambrosia of *X. pubescens* and *X. fuscatus* is deep black in its stain, or in its later stages, and the same fungus may serve both these species; but *X. xylographus*, a cosmopolitan species frequently found in hickory, oak, beech and the like, has a very different ambrosia, which is olive-green when dry, or leaves a stain of that color in the chambers. The ambrosia of *X. celsus*, a large species found in hickory, is dark brown in stain and in the form of its conidia is entirely different from that grown by any other of the species I have mentioned.

In the orange trees injured or killed by frost the most numerous borer is *Platypus compositus.* Its ambrosia is entirely different from that of the Xylebori in the orange, and stains the chambers dark brown. Several species of Platypus are found in the Southern States in all sorts of timber, conifers and deciduous trees alike. *P. compositus* attacks all sorts of trees, including our pines.

The scolytid boring into the whortleberry, which I brought to the Department of Agriculture last fall is *Corthylus punctatissimus.* It lives in the roots of several shrubs, as hazel, witch hazel, etc. Its ambrosia leaves a deep black stain. *Corthylus columbianus,* discovered by Hopkins, makes notable black stains in Liriodendron wood.

I have had the opportunity of examining three or four kinds of ambrosia and have found them very distinct in the form and arrangement of the conidia as well as in the habit of growth of the mycelium. There is, I think, very little doubt that the different species of ambrosia are connected with certain scolytid beetles irrespective of the wood in which they make their galleries. The different genera in which I have found the food to consist of ambrosia are *Platypus, Xyleborus, Monarthrum* and *Corthylus.* It is useless to give lists of plants attacked by these ambrosia-raising beetles because most of them make their galleries and brood chambers in a great variety of trees and shrubs Some species live preferably in the roots of plants and others in the trunks or larger branches, but very few species are restricted to one or even a few kinds of timber.

I expected to learn much about the forms of ambrosia found in galleries of the different borers in orange trees, but I find on my return here this winter that a ferment has taken complete possession of all the ambrosia which I have examined, and the operations of the beetles are for the time being at a standstill. A slide of the material now lining the galleries [Feb. 20, 1896] shows only fragments of the mycelium of the fungus, and the entire field swarms with bodies like yeast (or bacteria?) in active eruption. These spores form dense masses and entirely fill up many of the burrows, often smothering the insects. I am curious to know whether this is really the end of a prodigious attack that has been made by the beetles during the past summer upon the dying orange trees, oaks and other timber injured by the great freezes of last winter [Dec. 27–29, 1894 and Feb. 7–9, 1895], or whether it is only a temporary condition due to the inactivity of the beetles during the winter I should not be surprised to find that it has put an end to further increase of the colonies of ambrosia-eating insects by making it impossible for them to propagate their food fungus.—HENRY G. HUBBARD, Crescent City, Florida.

NOTE.—Mr. Hubbard reports (May 13) that the beetles were finally overwhelmed by this "intruding ferment," and now believes that their depredations are usually brought to an end in this manner.—E. F. S.

ZOOLOGY.

The Feeding Phenomena of Sea Anemones.—Nagel has claimed that only the tentacles of the sea anemones were stimulated by food, while Loeb has shown that other parts of the oral disc were equally sensitive. To settle which was correct Dr. Parker made his experiments on our common *Metridium marginatum.*[1] When the animal is expanded, carmine dropped on the tentacles is gradually carried outwards by the ciliary action until it is dropped outside the disc. In this there is at first only a slight muscular action, and then the tentacles are quiet as before. If, however, a bit of crab-flesh be dropped on the tentacles, these are stimulated much more. They now gradually bend inward, and the flesh, carried toward the tips of the tentacles like the carmine, is dropped inside the lips of the mouth. Experiments showed that this stimulation was produced by the juices of the meat, sugar, quinine, meat and picric acid—all substances with taste—as well as filter paper, rubber, etc., produced no stimulation. Each tentacle was stimulated alone. Between the tentacles and the lips is an intermediate zone in which no stimulation occurs. Bits of crab meat dropped upon it remain quiet for a time, and then gradually move outwards. Dr. Parker was not able to explain with certainty how. When, however,

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[1] Bull. Mus. Comp. Zoöl. XXIX, No. 2, 1896.